

SECTION 613 RIPRAP AND SLOPE AND BANK PROTECTION

613.01 DESCRIPTION. This work is the construction of protective rock, stones, gravel, or concrete coverings as specified.

Riprap is a cover of stone or fragmented rock, with or without grout, placed along embankment slopes, stream banks, culvert inlets and outlets, foundations, bridge berms, dikes, and other specified locations.

Bank protection is a cover of rock or coarse gravel placed on the side slopes of structure channels and other specified locations.

Concrete slope protection is a cover of portland cement concrete placed on slopes at structure ends.

613.02 MATERIALS. Furnish materials meeting the following requirements:

Handlaid, Random, and Grouted Riprap	Subsection 701.06
Cement Grout	Subsection 713.04
Bedding Material	Subsection 701.04.1
Bank Protection	Subsection 701.07
Class "D" Portland Cement Concrete	Section 551
Sand-Gravel Cushion	Subsection 701.08

613.03 CONSTRUCTION REQUIREMENTS.

613.03.1 Riprap.

- A. General.** Place the riprap at the locations specified in the Contract.

Key the riprap ends into the embankment slopes at least 2 feet (610 mm) from the outer face of the riprap for the full height of the riprap.

- B. Handlaid Riprap.** Bed the stones at right angles to the slope with the larger stones used in the lower courses. Lay the stones in close contact with staggered vertical joints and placed so each stone rests on the embankment slope instead of the underlying stones. Fill the spaces between the stones with smaller stones or rock, securely placed.

Finish the work to present an even, tight plane varying no more than 3-inches (75 mm) from the general contour of the revetment.

Provide a minimum riprap thickness of 12-inches (305 mm), measured perpendicular to the slope, or as specified.

- C. Random Riprap.** Place the stones on the slopes to form the specified cross section. Uniformly distribute the smaller stones throughout the work. Manipulate the stones by hand or machine to provide a uniform surface and stable mass.

Provide the riprap thickness specified on the plans.

Place the riprap around pipe openings without damaging the pipe. Repair damaged pipe at Contractor expense.

- D. Grouted Riprap.** Provide a minimum riprap thickness of 9-inches (230 mm) measured perpendicular to the slope, or as specified.

Place one or more layers of bedding material before placing the riprap as specified. Place each bedding layer on the prepared surface to the specified thickness in one operation without segregating the layer. Finish the top layer to produce an even surface free from mounds or ridges. Do not inter-mix the materials of each layer.

Fill the voids between stones with spalls or small stones so all stones are wedged or keyed. Prevent earth and sand from filling the spaces between the stones.

Finish the final surface to provide an even, tight surface with the plane not varying more than 3-inches (75 mm) from the general contour.

Wet the riprap surface and fill the crevices and openings with at least 3-inches (75 mm) of mortar. Immediately sweep the surface with a stiff broom.

Grouting may begin when the ambient temperature is at least 35 °F (2 °C) and rising and must stop when the ambient temperature is 30 °F (-1 °C) and falling.

Keep finished grout work moist for three days.

613.03.2 Bank Protection. Bank protection may be hand-placed or machine placed and leveled. Construct the finished bank protection to be stable with no voids larger than the smallest stone used in the work.

Use rock spalls or gravel to fill the voids. Not more than 5% of the total bank protection volume may be earth, sand, or rock material smaller than 3/16-inch (5 mm) for filling voids.

Bed the bank protection as shown in the Contract.

613.03.3 Concrete Slope Protection. Trench, shape, compact, and trim the slopes as specified before starting concrete work. Excess excavated material may be used elsewhere in the work or disposed of by the Contractor.

Construct the concrete slope protection as specified or directed.

613.04 METHOD OF MEASUREMENT.

613.04.1 Riprap.

A. Handlaid and Random Riprap. Handlaid and random riprap is measured by the cubic yard (cubic meter) to the nearest 0.1 cubic yard (0.1 m³) complete in place. The volume measured for payment is that bounded by the staked length and height and the plan thickness.

Excavation is incidental to and not measured for payment.

B. Grouted Riprap. Grouted riprap is measured by the square yard (square meter) to the nearest 0.1 square yard (0.1 m²) on the face of the revetment.

Excavation is incidental to and not measured for payment.

Bedding material is measured by the cubic yard (cubic meter) to the nearest 0.1 cubic yard (0.1 m³).

613.04.2 Bank Protection. Bank protection is measured by the cubic yard (cubic meter) to the nearest 0.1 cubic yard (0.1 m³) complete in place. The volume

measured for payment is that bounded by the staked length and height and the plan thickness.
Excavation and bedding material is not measured for payment.

613.04.3 Concrete Slope Protection. Concrete slope protection is measured by the square yard (square meter) to the nearest 0.1 square yard (0.1 m²). Measurement is made parallel to the surface of the exposed surface area including the surfaces of curbs and head walls. Excavation is incidental to the item and not measured for payment.

Sand-gravel cushion is measured by the cubic yard (cubic meter) compacted in place.

613.05 BASIS OF PAYMENT. Payment for the completed and accepted quantities is made under the following:

<u>Pay Item</u>	<u>Pay Unit</u>
Handlaid and Random Riprap	Cubic Yard (cubic meter)
Grouted Riprap	Square Yard (square meter)
Bank Protection	Cubic Yard (cubic meter)
Concrete Slope Protection	Square Yard (square meter)
Bedding Material	Cubic Yard (cubic meter)
Sand-Gravel Cushion	Cubic Yard (cubic meter)

Payment at the contract unit price is full compensation for all resources necessary to complete the item of work under the Contract.